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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/521,546

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Anthony Thomas Harcombe

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M/C 480-410-202

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EXAMINER

COLEMAN, KEITH A

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PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/521,546	Applicant(s) HARCOMBE ET AL.	
	Examiner KEITH COLEMAN	Art Unit 3783	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-12 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-12 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on ____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. ____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. ____. |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date ____. | 6) <input type="checkbox"/> Other: ____. |

DETAILED ACTION

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1, 2, 7, and 8 are rejected under 35 U.S.C. 102(b) as being anticipated by Coldren et al. (US Patent No. 6,113,014).

With regards to claim 1, the patent to Coldren et al. discloses a control method for a fuel injection system having a spill valve (i.e. spill valve 40, See Col. 2, Lines 25-30), nozzle control valve (i.e. needle valve 20, See Col. 2, Lines 48-53) and a valve needle (20) which is engageable with a seating (i.e. interior seating for nozzle 16, See Figure 1) to control fuel injection, the method comprising: applying a first drive current signal (i.e. current sent to solenoid 41, See Figure 4b) to the spill valve (40) to move the spill valve (40) into a closed state and applying a second drive current signal (i.e. current sent to solenoid 31, Figure 4C) to the nozzle control valve (20) to move the nozzle control valve (20) to an open state, thereby to lift the valve needle (20) from the seating to initiate a main injection of fuel, and modifying the first drive current signal (Figure 4b) applied to the spill valve (40) so as to move the spill valve (40) from the closed state to an open state during a spill valve opening period (Figure 4b) and modifying the second drive current signal (Figure 4C) applied to the nozzle control valve

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(20) to move the nozzle control valve (20) from the open state to a closed state during the spill valve (40) opening period, so as to urge the valve needle (20) towards its seating to terminate the main injection of fuel (See Figure 4B and 4C).

With regards to claim 2, the patent to Coldren et al. discloses including switching the fast drive current signal (via control circuit 50, See Col. 3, Lines 50-60) off to provide a first actuation pulse (See Figure 4B) to initiate the spill valve (40, See Figure 4B) opening period (Figures 4B and 4C shows time versus opening for the spill port) and switching the first drive current signal (Figure 4B) on and then off again to provide a second actuation pulse (Figure 4C) prior to termination of the spill valve opening period (See Figure 2).

With regards to claim 7, the patent to Coldren et al. discloses wherein the second drive current signal (i.e. from control circuit 50 to solenoid 41, Figure 4C) is switched on to move the nozzle control valve (20) to its open state (See Col. 3, Lines 60-65).

With regards claim 8, the patent to Coldren et al. discloses wherein the second drive current signal (Figure 4C) is switched off to move the nozzle control valve (20) to its open state.

Claim Rejections - 35 USC § 103

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The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 5 and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Coldren et al. (US Patent No. 6,113,014).

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With regards to claim 5, the patent to Coldren et al. discloses all the limitations of the claimed subject matter including wherein the first drive current signal (Figure 4B) is modified to cause the spill valve (40) to move towards its open state at a time before a time at which the second drive current signal (Figure 4C) is modified to cause the nozzle control valve (20) to move towards its closed state, except positively disclosing a time of between 0.05 and 2 milliseconds.

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify the opening and closing times of the spill and nozzle control valves of Coldren et al. with a time of between 0.05 and 2 milliseconds, because the modification is invariably an optimized range. See MPEP 2144.04. *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955) (Claimed process which was performed at a temperature between 40°C and 80°C and an acid concentration between 25% and 70% was held to be *prima facie* obvious over a reference process which differed from the claims only in that the reference process was performed at a temperature of 100°C and an acid concentration of 10%.); see also *Peterson*, 315 F.3d at 1330, 65 USPQ2d at 1382 (“The normal desire of scientists or artisans to improve upon what is already generally known provides the motivation to determine where in a disclosed set of percentage ranges is the optimum combination of percentages.”)

With regards to claim 6, the patent to Coldren et al. discloses all the limitations of the claimed subject matter except positively disclosing wherein the first drive current

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signal is modified between 0. 1 and 1 millisecond before the second drive current signal is modified.

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify the valve timing of Coldren et al. with wherein the first drive current signal is modified between 0. 1 and 1 millisecond before the second drive current signal is modified, because the modification is invariably an optimized range. See MPEP 2144.04. *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955) (Claimed process which was performed at a temperature between 40°C and 80°C and an acid concentration between 25% and 70% was held to be *prima facie* obvious over a reference process which differed from the claims only in that the reference process was performed at a temperature of 100°C and an acid concentration of 10%.); see also *Peterson*, 315 F.3d at 1330, 65 USPQ2d at 1382 (“The normal desire of scientists or artisans to improve upon what is already generally known provides the motivation to determine where in a disclosed set of percentage ranges is the optimum combination of percentages.”)

Claims 3 and 4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Coldren et al. (US Patent No. 6,113,014) in view of Archer et al. (US Patent No. 5,825,216)

With regards to claim 3, the patent to Coldren et al. discloses all the limitations of the claimed subject matter except positively disclosing monitoring a glitch detection signal indicative of spill valve opening and modifying the first drive current signal to provide the second actuation pulse at a time, relative to termination of the spill valve opening period, in dependence upon the glitch detection signal.

Archer et al. discloses monitoring a glitch detection signal (Col. 3, Lines 3-11).

Since Archer et al. explicitly states on Col. 1, Lines 9-14 that "This invention relates to a drive circuit for controlling the flow of current in the solenoid of an electromagnetically operable valve in particular but not exclusively, a spill control valve of a fuel injection system for a compression ignition engine." And explicitly states on Col. 3, Lines 3-11 that "This period of current decay is arranged so that closure of the valve member takes place therein and at the instant of closure a small glitch or discontinuity occurs in the current waveform. This is detected [i.e. monitored] by the sensing circuit 29. Following the glitch or a predetermined time after opening the switch 26, it is reclosed and then switched to maintain a mean level of holding current for so long as it is required to maintain the spill valve closed. ", it would have been obvious to a person of ordinary skill in the art at the time the invention was made to provide the fuel injector of Coldren et al. with monitoring a glitch detection signal indicative of spill valve opening and modifying the first drive current signal to provide the second actuation pulse at a time, relative to termination of the spill valve opening period, in dependence upon the glitch detection signal in view of the teaching to Archer et al., in order to

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ensure that fuel is delivered to the associated engine at the correct time (Col. 1, Lines 30-35 from Archer et al.)

With regards to claim 4, the patent to Coldren et al. discloses all the limitations of the claimed subject matter except positively disclosing including monitoring said glitch detection signal periodically during injection events.

Archer et al. discloses including monitoring said glitch detection signal periodically during injection events (Col. 3, Lines 3-11). See rejection in Claim 3.

Claims 9-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Coldren et al. (US Patent No. 6,113,014) in view of Straub (US Patent No. 7,150,410)

With regards claim 9, the patent to Coldren et al. discloses all the limitations of the claimed subject matter including wherein a control method for delivering a main injection of fuel followed by a post injection of fuel (i.e. fuel to be injected or post injection after the opening and closing of the spill and nozzle valves, See Figures 1, 4B, and 4C), the method comprising: actuating a spill valve (40) and a nozzle control valve (20) to initiate the main injection of fuel, terminating the main injection of fuel by actuating the spill valve (40) at a first time to cause the spill valve (40) to move to an open state and (ii) actuating a nozzle control valve (20) at a second time to cause the nozzle control valve (20) to move into a closed state, subsequently actuating the spill valve (40) at a third time to cause the spill valve (40) to move from its open state to a

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closed state, and initiating the post injection of fuel by actuating the nozzle control valve (20) to move into an open state (See Figure 4B and 4C, See Rejection in Claim 1), except positively disclosing whereby the difference between the first and third times is selected to provide a relatively high pressure post injection of fuel so as to reduce smoke emissions levels.

Straub discloses whereby the timing of the injection valves is selected to provide a relatively high pressure post injection of fuel so as to reduce smoke emissions levels (Col. 1, Lines 25-45).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify the timing of Coldren et al. with whereby the difference between the first and third times is selected to provide a relatively high pressure post injection of fuel so as to reduce smoke emissions levels in view of the teaching to Straub, in order to meet the demands of greater fuel economy, cleaner burning and fewer emissions (Col. 1, Lines 35-40 from Straub)

With regards to claim 10, the combination of Coldren et al. and Straub discloses all the limitations of the claimed subject matter including whereby the spill valve (40, See Figure 4B and 4C, See Rejection in Claim 1) is actuated to move between its open and closed states by modifying a spill valve drive current signal (Figure 4B).

With regards to claims 11 and 12, the patent to Coldren et al. discloses all the limitations of the claimed subject matter including wherein the relative timing between

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opening and closure of the spill valve (40) is selected to ensure a pressure (i.e. desired magnitude, Col. 4, Lines 15-25), except positively disclosing the post injection pressure is at least 1700 or 2000 bars.

Straub discloses an injection pressure is at least 1700 bar (2000 bars or approximately 30,000 psi, Col. 1, Line 33).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify the predetermined injection pressure of Coldren et al. with the post injection pressure is at least 1700 bar. in view of the teaching to Straub, in order to meet the demands of greater fuel economy, cleaner burning and fewer emissions (Col. 1, Lines 35-40 from Straub)

Response to Arguments

1. Applicant's arguments filed 6/24/2010 have been fully considered but they are not persuasive.
2. With regards to Applicant's arguments on Pages 1-3 regarding the limitation of applying a first drive control signal to the spill valve, and applying a second drive current signal to the nozzle control valve, the patent to Coldren clearly shows two valves as the claims are amended.

Conclusion

3. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP

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§ 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to KEITH COLEMAN whose telephone number is (571)270-3516. The examiner can normally be reached on 5:30-4:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mike Cuff can be reached on (571)272-6778. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

KAC

/K. C./

Examiner, Art Unit 3783

/Michael Cuff/

Supervisory Patent Examiner, Art Unit 3741